CLIMATE PROGRAM OFFICE

Climate Variability and Predictability

What physical mechanisms are responsible for decadal-scale climate variability?

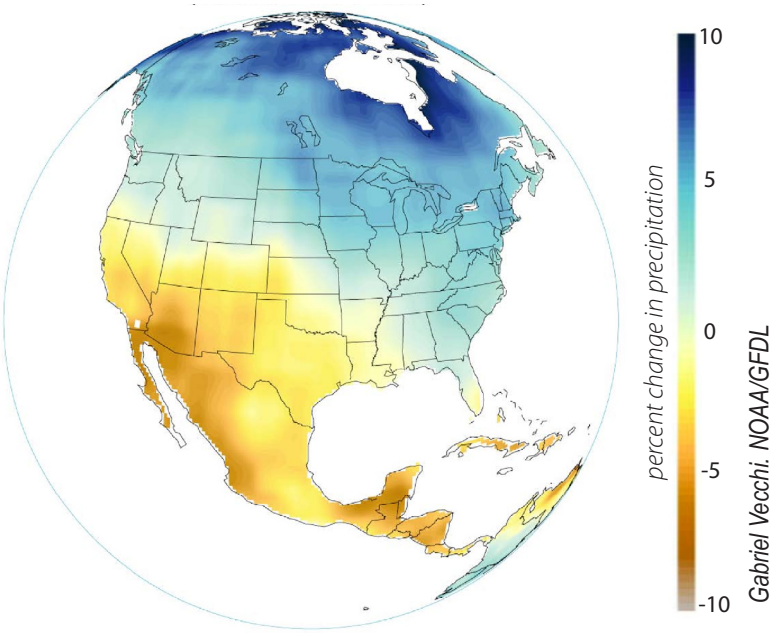
What observing systems and analysis methods are required to capture and characterize this variability?

Are there inherent limitations on our ability to predict climate?

The Climate Variability and Predictability (CVP) program supports research to examine interrelationships between the ocean-atmosphere-land system and their influence on decadal-scale climate variability. The program funds an array of modeling and diagnostic studies focused on large-scale climate variability and change, including abrupt climate change.

Research supported by the CVP program is increasing our ability to augment annual climate predictions and century-scale projections with decadal-scale predictions. Decadal-scale predictions require the capability to predict both the short-term natural variability of the climate system as well as its long-term trends. Decadal projections have increasing importance because the climate system is not changing in a simple linear fashion. Rather, changes result from a combination of natural climate variability and human-induced causes. The interaction of these two factors may cause climate to change abruptly.

Projected Annual Change in Precipitation for 2020-2041 compared to 1950-2000



Climate models project widespread changes in precipitation patterns for 2021-2040. This decadal-scale prediction shows increasing aridity for southwestern North America while northern portions of the continent become wetter. The map shows the result of simulations from 19 climate models.

CVP Objectives

- Advance research to examine the likelihood of climate "surprises," such as abrupt climate change.
- Understand the physical mechanisms giving rise to global climate variability and change on sub-decadal and longer timescales.
- Determine the spatial and temporal extent to which climate variability is predictable.
- Develop the observational, theoretical, and computational means to build a robust capability for decadal-scale climate predictions.

Climate Variability and Predictability Program http://climate.noaa.gov/cpo_pa/cvp

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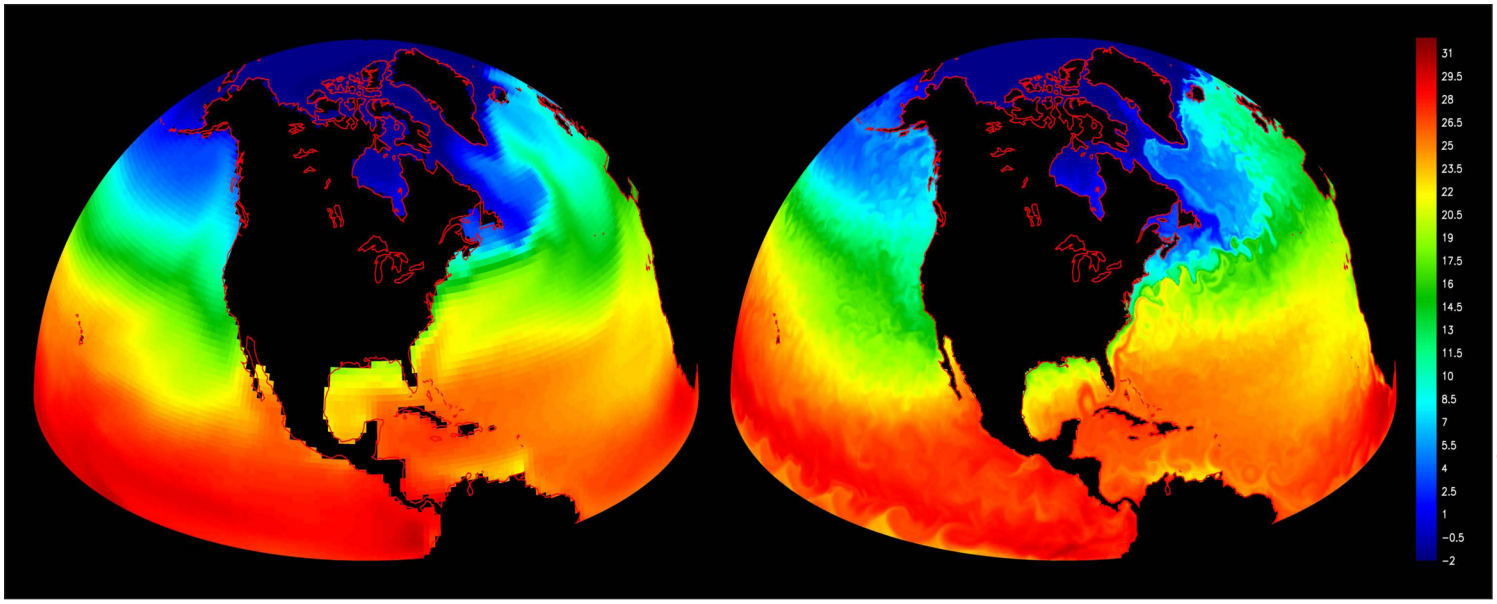

Keith Dixon, GFDL

In addition to supporting research that results in climate projections on decadal time scales, CVP supports efforts to increase the spatial resolution of climate models and projections. This visualization shows model-simulated sea surface temperatures in degrees Celcius generated by two different climate models. Compare the relatively blocky view of the image on the left with the fine details visible in the image on the right. The additional detail in the image on the right is the result of the higher grid resolution of the newer climate model that produced it. The new model requires much more computing power than the older model, but reveals details of ocean currents and mixing that can lead to improvements in our understanding of the climate system.

Approaches

The Climate Variability and Predictability Program funds modeling and diagnostic research projects to:

- Develop and refine global climate models that represent the complexity of the ocean-atmosphere-land climate system.
- Analyze model outputs to identify sources of predictability in the climate system, and to determine the mechanisms by which they function.
- Develop an understanding of the Atlantic Meridional Overturning Circulation in order to initialize models used for decadal climate prediction.

CVP Highlight

Research supported by the CVP program produces decadal-scale climate projections through climate modeling efforts. Results from nineteen different climate models run by groups of scientists around the world show widespread agreement on projections for precipitation patterns in the coming decades (see graphic on previous page). According to the models, decreased precipitation in the southwestern portion of North America becomes marked early in the current century. By mid-century, levels of aridity that were observed in the 1930s Dust Bowl and the 1950s multiyear drought could become the new climate. The projected result is perpetual drought in the Southwest.